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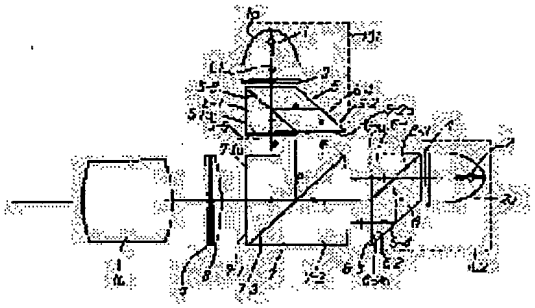
(54) ILLUMINATOR AND PROJECTING DEVICE USING THE SAME

(57)Abstract:

PURPOSE: To provide an illuminator capable of observing a bright projected picture and a projected picture using the same by efficiently introducing a light beam transmitted from a light source and increasing the utilizing efficiency of the light beam.

CONSTITUTION: This device is composed of light sources 1, 2, and at least two polarization generating means 101, 102 comprising polarization elements 5, 6 separating light beams from the light sources 1, 2 into the beams of two polarization components and making one of the polarizing directions of two separated polarization components coincident with the polarizing direction of the other beam to emit it, light beams having the different polarizing directions from each other are made to be transmitted from two polarization generating means 101, 102, the light beams from two polarization generating means 101, 102 are synthesized through a polarization beam splitter 7 and made to emit in one direction so as to irradiate the surface to be irradiated.



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CLAIMS

[Claim(s)]
[Claim 1] At least two polarization generation means to have the polarizing element which divides the flux of light from the light source and this light source into the flux of light of two polarization components, and one polarization direction is made in agreement with the polarization direction of the flux of light of another side, and injects it between two this separated polarization components are established. this — the flux of light from which the polarization direction differs mutually from two polarization generation means is injected — making — making — this — the lighting system characterized by compounding the flux of light from two polarization generation means through a polarization beam splitter, making it inject from an one direction, and making it irradiate an irradiated plane.
[Claim 2] At least two polarization generation means to have the polarizing element which divides the flux of light from the light source and this light source into the flux of light of two polarization components, and one polarization direction is made in agreement with the polarization direction of the flux of light of another side, and injects it between two this separated polarization components are established. The flux of light from which the polarization direction differs mutually from two polarization generation means is made inject and made. this — this — the projection equipment characterized by having compounded the flux of light from two polarization generation means through the polarization beam splitter, having illuminated the projection image by the flux of light from this polarization beam splitter, and projecting this projection image on a predetermined side with a projection lens.
[Claim 3] At least two polarization generation means to have the polarizing element which divides the flux of light from the light source and this light source into the flux of light of two polarization components, and one polarization direction is made in agreement with the polarization direction of the flux of light of another side, and injects it between two this separated polarization components are established. The flux of light from which the polarization direction differs mutually from two polarization generation means is made inject and made. this — The flux of light from two polarization generation means is compounded through a polarization beam splitter. this — Projection equipment which carries out the light guide of the flux of light from this polarization beam splitter to a liquid crystal display component through the polarization member which changes and injects incident light to the flux of light of the polarization direction of an one direction, and is characterized by projecting the image information displayed with this liquid crystal display component on a predetermined side with a projector lens.
[Claim 4] Said liquid crystal display component is projection equipment of claim 3 characterized by being the display device of the type turning around the polarization direction.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention projected [about the projection equipment which used a lighting system and it, aim at a deployment of the flux of light from two or more light sources especially, illuminate a projection image efficiently, and / on the screen side] this projection image with the projection lens for example, is suitable for equipments, such as a slide projector and a liquid crystal projector.
[0002]
[Description of the Prior Art] The projection equipment which was made to carry out expansion projection of the projection image subject copy conventionally displayed on the film, the liquid crystal light valve (liquid crystal display component), etc. on the screen side is proposed [that it is various and].
[0003] In carrying out expansion projection of this image in conventional projection equipment, using the liquid crystal panel (liquid crystal light valve) of a transparency mold as a projection image, he extracts the flux of light of the linearly polarized light component of an one direction among the flux of lights injected from the light source, and is trying to illuminate a projection image by this flux of light. And expansion projection of this projection image is carried out on the screen side with the projection lens.
[0004]
[Problem(s) to be Solved by the Invention] With conventional projection equipment, since only the flux of light of the linearly polarized light component of an one direction was used for lighting, there was a trouble that only 50% of use effectiveness became [lighting effectiveness] low at the maximum among the flux of lights by which outgoing radiation is carried out from the light source.
[0005] a perimeter is not made not much dark as projection equipment — also coming out — it enables it to observe a projection image — being alike — it is necessary to make a projection image bright It is necessary to increase, put in order and arrange the number of the light sources for lighting to obtain a bright projection image generally, or to use the large-scale light source which injects a powerful light.
[0006] However, although the total quantity of light increased when the number of the light sources was increased or the large-scale light source was used, the light source spread and there was a trouble that the whole equipment was enlarged and complicated.
[0007] This invention prepares the polarizing element which arranges the polarization direction of the flux of light which carried out incidence to two or more light sources for these two or more light sources of every, and was made to carry out outgoing radiation. Compound the flux of light from this polarizing element through a polarization beam splitter, and a deployment of the flux of light from the light source is aimed at by using the this compounded flux of light. A projection image is illuminated efficiently and it aims at offer of the lighting system with which a bright projection image is easily obtained on a screen side, and the projection equipment using it.
[0008]
[Means for Solving the Problem] The lighting system of this invention divides the flux of light from the

light source and this light source into the flux of light of two polarization components. At least two polarization generation means to have the polarizing element which one polarization direction is made in agreement with the polarization direction of the flux of light of another side, and injects it between two separated this polarization components are established. this — the flux of light from which the polarization direction differs mutually from two polarization generation means is injected — making — making — this — it is characterized by compounding the flux of light from two polarization generation means through a polarization beam splitter, making it inject from an one direction, and making it irradiate an irradiated plane.

[0009] The projection equipment of this invention divides the flux of light from the light source (1–1) and this light source into the flux of light of two polarization components. At least two polarization generation means to have the polarizing element which one polarization direction is made in agreement with the polarization direction of the flux of light of another side, and injects it between two separated this polarization components are established. The flux of light from which the polarization direction differs mutually from two polarization generation means is made inject and made. this — this — it is characterized by having compounded the flux of light from two polarization generation means through the polarization beam splitter, having illuminated the projection image by the flux of light from this polarization beam splitter, and projecting this projection image on a predetermined side with a projection lens.

[0010] (1–2) Divide the flux of light from the light source and this light source into the flux of light of two polarization components. At least two polarization generation means to have the polarizing element which one polarization direction is made in agreement with the polarization direction of the flux of light of another side, and injects it between two separated this polarization components are established. The flux of light from which the polarization direction differs mutually from two polarization generation means is made inject and made. this — The flux of light from two polarization generation means is compounded through a polarization beam splitter. this — The light guide of the flux of light from this polarization beam splitter is carried out to a liquid crystal display component through the polarization member which changes and injects incident light to the flux of light of the polarization direction of an one direction, and it is characterized by projecting the image information displayed with this liquid crystal display component on a predetermined side with a projector lens.

[0011] It is characterized by said especially liquid crystal display component being a display device of the type turning around the polarization direction.

[0012]

[Example] Drawing 1 is the important section schematic diagram of the optical system of the example 1 of this invention. 101,102 in drawing is a polarization generation means respectively, and is injecting the linearly polarized light from which the polarization direction differs mutually (the polarization directions differ 90 degrees).

[0013] From the polarization generation means 101, S polarization with the polarization direction perpendicular to space is injected, and this drawing shows the case where P polarization with the polarization direction parallel to space is injected, from the polarization generation means 102.

[0014] Among drawing, one (2) is the light source (light source means), and consists of the halogen lamp or the metal halide lamp. 1a (2a) is a reflector, consists of reflectors, such as a paraboloid configuration, and has drawn the flux of light emitted from the light source 1 (2) in the direction of the projection image 9 mentioned later effectively. 3 (4) is a filter and has cut the ultraviolet rays and infrared radiation which are contained in the flux of light from the light source 1 (2). 5 (6) is a polarizing element, makes the polarization direction of incoming beams in agreement, and is made to inject. The polarizing element 5 (6) has the parallelogram prism 5–2 (6–2), the rectangular prism 5–1 (6–1), and the optical element 5–5 (6–5).

[0015] First, reflect S polarization by the polarization film 5–3 among the flux of lights from the light source 1, it is made to reflect by the mirror 5–4, and the polarizing element 5 is injected from injection side 5–2a. Moreover, P polarization passes the polarization film 5–3, and is made to inject from injection

side 5-1a as S polarization through an optical element 5-5 like lambda/2 plate which rotates the polarization direction 90 degrees among the flux of lights from the light source 1.
[0016] On the other hand, the polarizing element 6 is injected from injection side 6-2a as P polarization through an optical element 6-5 like lambda/2 plate which rotates the polarization direction 90 degrees, after reflecting S polarization by the polarization film 6-3 among the flux of lights from the light source 2 and making it reflect by the mirror 6-4. Moreover, P polarization passes the polarization film 6-3, and is made to inject from injection side 6-1a among the flux of lights from the light source 2.
[0017] 7 is a polarization beam splitter, reflects S polarization with the polarization film 7-3, and is making P polarization penetrate. Incidence of the flux of light from the polarization generation means 101,102 is respectively carried out to a polarization beam splitter 7. The two linearly polarized lights the linearly polarized lights and the polarization direction from the polarization generation means 101,102 cross at right angles mutually by this are compounded by the polarization beam splitter 7, and it is made to inject from injection side 7-1a.
[0018] 8 is a condenser lens, condenses the flux of light (P polarization and S polarization) from a polarization beam splitter 7, and is illuminating the projection images 9, such as a slide. 10 is a projection lens and is carrying out expansion projection of the projection image 9 on the screen (un-illustrating) side.
[0019] At this example, S polarization and the flux of light from the light source 2 are changed into P polarization for the flux of light from the light source 1, and where both flux of lights are piled up in the direction of an optical axis by the polarization beam splitter, it is compounding. This used without loss of the flux of light from the two light sources, the projection image was illuminated with double brightness compared with the conventional approach, and the bright projection image has been obtained on the screen side.
[0020] Drawing 2 is the important section schematic diagram of the example 2 of this invention.
[0021] This example shows the case where it applies to the electrochromatic display projector using the liquid crystal display component which has the property to rotate the polarization direction as a projection image.
[0022] In drawing 2 , since the configuration of the polarization generation means 101,102 and a polarization beam splitter 7 is the same as the example 1 of drawing 1 , it explains the configuration after a polarization beam splitter 7.
[0023] 20 is a condensing member, arranges and constitutes two or more cylindrical lenses perpendicularly prolonged in space, and is condensing the flux of light from a polarization beam splitter 7. 103 is a polarization member and has the optical operation which arranges and injects the polarization direction of incoming beams. In case the polarization member 103 joins two or more detailed parallelogram prism in the direction of one dimension, it has formed the polarization film 23 in the plane of composition with the parallelogram prism 21 and 22. And the slant face 24 of the parallelogram prism 21 was used as the total reflection mirror, and the phase plate 25 is formed in the injection side of parallelogram prism.
[0024] At this example, it constitutes from a member of the flat configuration where two or more such units were arranged in the direction of one dimension.
[0025] In this example, the polarization direction of the incoming beams from the condensing member 20 is made in agreement by the polarization member 103 of such a configuration, and it is injecting.
[0026] 15-1, 15-2, and 15-3 are liquid crystal panels respectively, display the monochrome image corresponding to each color of red (R), green (G), and blue (B), for example, consist of liquid crystal display components, such as TN mold.
[0027] 11 is the 1st dichroic mirror and has divided the flux of light from the polarization member 103 into the 1st colored light (for example, red) and 2nd and 3rd colored light (for example, G, B). 12 is the 2nd dichroic mirror and is divided into the 2nd colored light (G) and 3rd colored light (B). 16 is the total reflection mirror which reflects the 3rd colored light (B), and 13 is a total reflection mirror which reflects the 1st colored light (R). 17 is the 3rd dichroic mirror and is compounding the 1st colored light (R) and

2nd colored light (G). 18 is the 4th dichroic mirror and is compounding the 1st and 2nd colored light (R, G) and 3rd colored light (B).

[0028] 10 is a projector lens (projection lens), compounds the image (projection image subject copy) of each liquid crystal panel 15-1, 15-2, and 15-3, and is carrying out expansion projection for the predetermined scale factor on the screen side. 14-1, 14-2, and 14-3 are condenser lenses respectively, and are condensing the illumination-light bundle which results in each liquid crystal panel 15-1, 15-23, and 15-3 on the panel side pupil of a projector lens 10.

[0029] the polarizing filter (un-illustrating) with which the polarization direction intersects perpendicularly before and after each liquid crystal panel 15-1, 15-2, and 15-3 -- him -- The polarizing filter by the side of the incidence of this liquid crystal panel 15-1, 15-2, and 15-3 has the optical operation as a polarizer which considers an illumination-light bundle as polarization. The polarizing filter by the side of injection omits the flux of light in which the polarization direction does not circle by this liquid crystal panel 15-1, 15-2, and 15-3, and has the optical operation as an analyzer to modulate.

[0030] In this drawing, the image information formed in each liquid crystal panel 15-1, 15-2, and 15-3 of the above configurations is piled up, and expansion projection is carried out on the screen (un-illustrating) side with the projector lens 10.

[0031] If the illumination light which injected the polarization beam splitter 7 in this example carries out incidence to a liquid crystal panel 15-1, 15-2, and 15-3 as it is, polarization of an one direction will be absorbed with the polarizing plate prepared in the light source side of a liquid crystal panel, and the effectiveness of this invention will not be demonstrated.

[0032] So, in this example, since brightness is doubled, between the polarization beam splitter 7 and the liquid crystal panel which is a projection image, the polarization member 103 which arranges incident light with polarization of the same direction as the polarization shaft of the above-mentioned polarizing plate, and injects it has been formed. In addition, this polarization member 103 may be the same as said polarizing element 5 or 6.

[0033] In this example, by the above configurations, a deployment of the flux of light from the light source is aimed at like an example 1, and the projection image is illuminated. in addition, this example -- setting -- (**) -- macromolecule distributed liquid crystal (Polymer-Dispersed Liquid Crystal) is used for a liquid crystal panel, and it can be used also for the liquid crystal projector constituted from schlieren optical system. At this time, the polarization member between a polarization beam splitter and the liquid crystal panel which is a projection image is unnecessary.

[0034] (b) This invention is applicable also to a projector or a simple lighting system like a headlight.

[0035] (c) Compared with the case where used 2 sets of illumination systems of an example 1, and a configuration which is further piled up by the polarization beam splitter is also possible, and the one light source is used in that case, the light source of one about 4 times the brightness of this will be acquired.

[0036]

[Effect of the Invention] According to this invention, the polarizing element which arranges the polarization direction of the flux of light which carried out incidence to two or more light sources for these two or more light sources of every, and was made to carry out outgoing radiation is prepared as mentioned above. Compound the flux of light from this polarizing element through a polarization beam splitter, and a deployment of the flux of light from the light source is aimed at by using the this compounded flux of light. A projection image can be illuminated efficiently and the lighting system with which a bright projection image is easily obtained on a screen side, and the projection equipment using it can be attained.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The important section schematic diagram of the example 1 of this invention
[Drawing 2] The important section schematic diagram of the example 2 of this invention
[Description of Notations]
101,102 Polarization generation means
103 Polarization Member
1 Two Light source
3 Four Filter
5 Six Polarizing element
7 Polarization Beam Splitter
8 Condenser Lens
9 Projection Image
10 Projection Lens
15-1, 15-2, 15-3 Liquid crystal display component
11, 12, 17, 18 Dichroic mirror

[Translation done.]